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KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES P2

COMMON TEST

JUNE 2024

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MARKS: 75

TIME: 1½ hours

This question paper consists of 7 pages and a periodic table.

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INSTRUCTIONS AND INFORMATION TO CANDIDATES

1. Write your name on the **ANSWER BOOK.**
2. This question paper consists of FIVE questions. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two subsections, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You may use appropriate mathematical instruments.
8. You are advised to use the attached PERIODIC TABLE.
9. Show ALL formulae and substitutions in ALL calculations.
10. Round off your final numerical answers to a minimum of TWO decimal places.
11. Give brief motivations, discussions, et cetera where required.

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QUESTION 1 (start on a new page)

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A – D) next to the question number (1.1 – 1.5) in the ANSWER BOOK, for example 1.6 D.

1.1 Which ONE of the following combinations represents INTERMOLECULAR forces ONLY?

A Ionic bonding and Covalent bonding
B Covalent bonding and London forces
C Hydrogen bonding and London forces
D Dipole-dipole forces and Covalent bonding (2)

1.2 An example of a NON-POLAR molecule with POLAR COVALENT bonds is:

A PCl_3
B CCl_4
C HCl
D H_2O (2)

1.3 For which ONE of the following pairs do the molecules have the SAME MOLECULAR shape?

A BeF_2 and CO_2
B H_2O and CO_2
C BF_3 and CCl_4
D $BeCl_2$ and H_2O (2)

1.4 In which ONE of the following compounds is the bonding ionic?

A CCl_4
B Cl_2
C HCl
D KCl (2)

1.5 Which of the statements below is/are TRUE for the WATER molecule?

(i) Hydrogen bonding occurs between O and H atoms to form H_2O molecules.
(ii) Hydrogen bonding occurs between H_2O molecules.
(ii) Covalent bonding occurs between O and H atoms to form H_2O molecules.

A (i) only
B (i) and (ii) only
C (i) and (iii) only
D (ii) and (iii) only (2)

[10]

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QUESTION 2 (start on a new page)

2.1 Define the following terms:

2.1.1 Covalent bond (1)

2.1.2 Molecule (1)

2.1.3 Lone pair (2)

Consider the following substances:

NaCℓ O_2 CO_2 H_2O H_2 NH_3 N_2 CO

Answer the following questions based on the above.

2.2 Draw Lewis diagrams for the following:

2.2.1 Carbon dioxide (2)

2.2.2 Ammonia (2)

2.3 Consider the central atom of the ammonia molecule. How many

2.3.1 lone pairs of electrons are there on this central atom? (1)

2.3.2 bonded pairs of electrons are there on this central atom? (1)

2.4 Name the type of chemical bond that exists in each of the following compounds:

2.4.1 N_2 (1)

2.4.2 CO_2 (1)

2.5 Name TWO substances from the list above that can form dative covalent bonds. (2)

2.6 Write down the NAME AND FORMULA of the ion that forms as a result of the dative covalent bonds for each of the substances mentioned in QUESTION 2.5 above. (4)

2.7 Write down the number of valence electrons present in an atom of nitrogen. (1)

2.8 CO and CO_2 are molecules that have only C – O bonds, and are both linear in shape.

2.8.1 Define the term *electronegativity*. (2)

2.8.2 Calculate the difference in electronegativity (ΔEN) for the C – O bond. (2)

2.8.3 Explain why CO is a POLAR molecule, while CO_2 is NON-POLAR molecule (4)

[27]

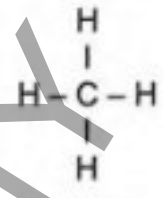
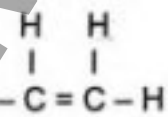
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QUESTION 3 (start on a new page)

Study the table below and answer the questions that follow.

	Bonded atoms	Bond length (pm)	Bond energy ($kJ.mol^{-1}$)	Example of carbon compound
A	C – C	154	347	 Methane
B	C = C	134	614	 Ethene
C	C ≡ C	121	839	H – C ≡ C – H Acetylene/Ethyne

3.1 Define the term *bond order.* (2)

3.2 What is the bond order of **B** in the table? (1)

3.3 What is the relationship between:

3.3.1 bond order and bond length (1)

3.3.2 bond length and bond energy (1)

3.4 Acetylene (C_2H_2) is the world's most efficient and hottest burning welding gas. Use the table above to calculate the amount of energy needed to break all the bonds in 1 mol of C_2H_2, if the energy for a C – H bond is 437 $kJ.mol^{-1}$. (3)

[8]

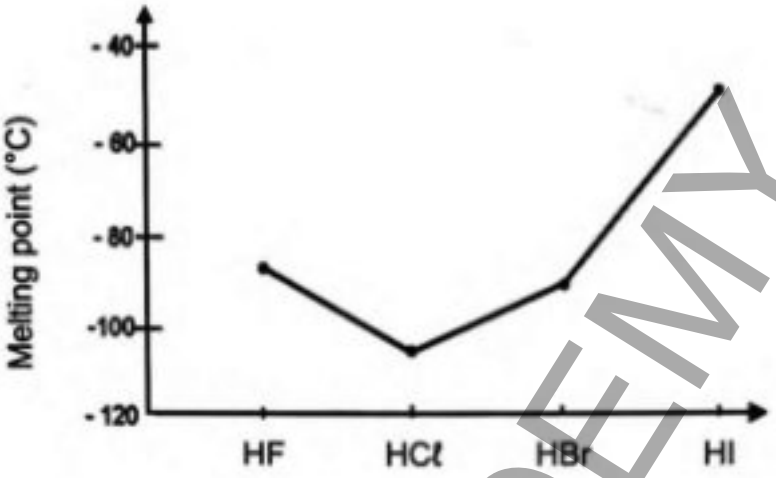
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QUESTION 4 (start on a new page)

4.1 The melting points of four hydrogen halides are represented in the graph below.



4.1.1 Explain the meaning of the term *intermolecular force.* (2)

4.1.2 Define the term *melting point.* (2)

4.1.3 Provide a label for the x-axis on the graph. (1)

4.1.4 Identify the type of intermolecular forces present in HBr. (1)

4.1.5 Fully explain the difference in melting points between:

a) HF and HCl (4)

b) HI and HCl (4)

4.1.6 NAME the compound that will need the most amount of energy to melt. (1)

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4.2 The boiling points of three liquids are given below:

Compound	Boiling point
CH_4	-161
CH_3OH	65
H_2O	100

4.2.1 Define the term *boiling point*. (2)

4.2.2 Explain the difference in the boiling points of the above three compounds. (5)

4.2.3 NAME the molecule that will have the highest vapour pressure. Provide a reason for the answer. (2)

[24]

QUESTION 5 (start on a new page)

5.1 Define the term *solubility*. (2)

5.2 Iodine (I_2) is soluble in carbon tetrachloride ($CC\ell_4$), but is insoluble in water (H_2O). Fully account for this observation in terms of the forces between the particles. (4)
[6]

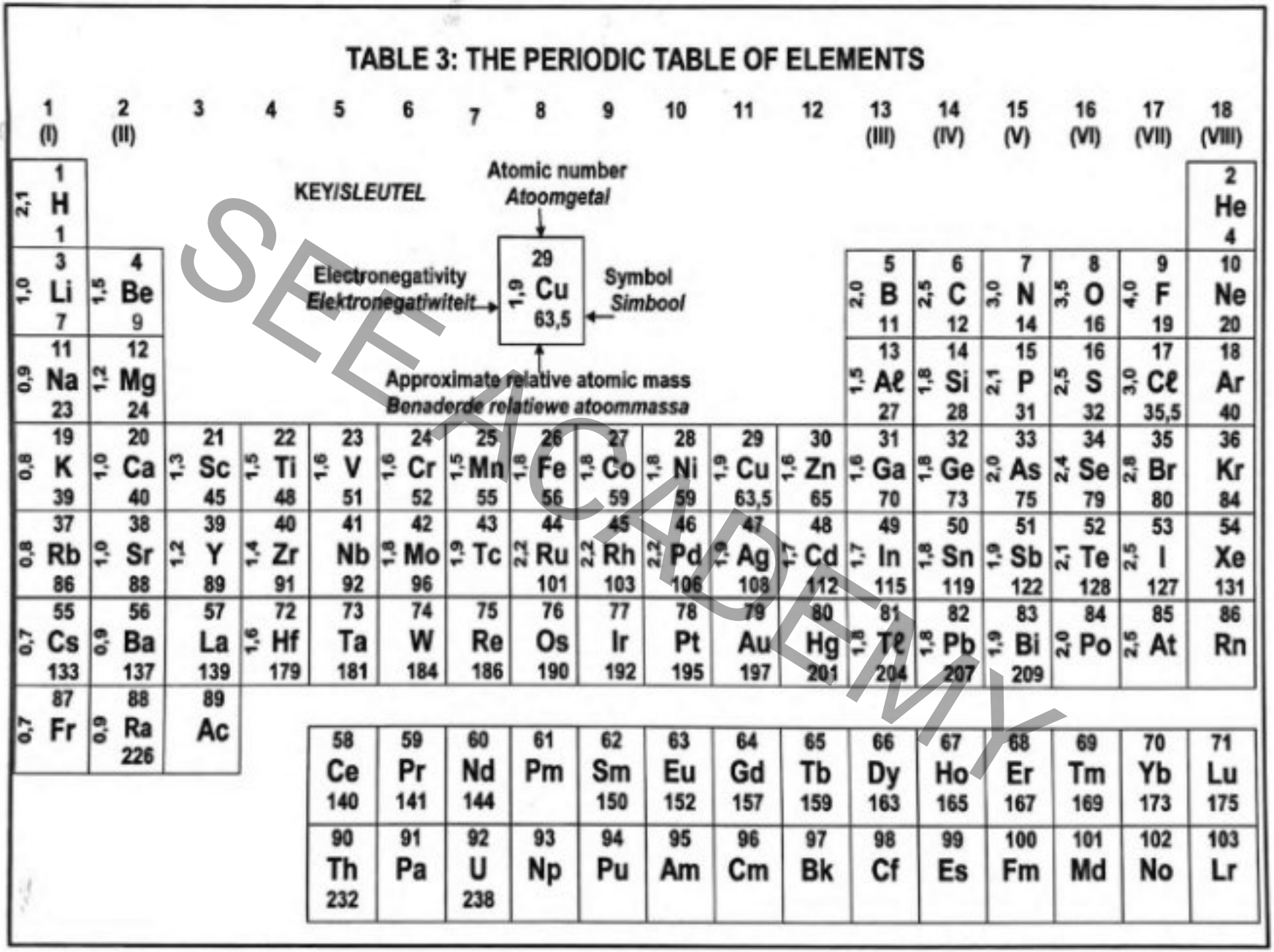
TOTAL MARKS: 75

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TABLE 3: THE PERIODIC TABLE OF ELEMENTS



1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 H 1																	2 He 4
1,0 Li 7	1,5 Be 9											2,0 B 11	2,5 C 12	3,0 N 14	3,5 O 16	4,0 F 19	10 Ne 20
0,9 Na 23	1,2 Mg 24											1,5 Aℓ 27	1,8 Si 28	2,1 P 31	2,5 S 32	3,0 Cℓ 35,5	18 Ar 40
0,8 K 39	1,0 Ca 40	1,3 Sc 45	1,5 Ti 48	1,6 V 51	1,6 Cr 52	1,5 Mn 55	1,8 Fe 56	1,8 Co 59	1,8 Ni 59	1,9 Cu 63,5	1,6 Zn 65	1,6 Ga 70	1,8 Ge 73	2,0 As 75	2,4 Se 79	2,8 Br 80	36 Kr 84
0,8 Rb 86	1,0 Sr 88	1,2 Y 89	1,4 Zr 91	41 Nb 92	1,8 Mo 96	1,9 Tc	2,2 Ru 101	2,2 Rh 103	2,2 Pd 106	1,9 Ag 108	1,7 Cd 112	1,7 In 115	1,8 Sn 119	1,9 Sb 122	2,1 Te 128	2,5 I 127	54 Xe 131
0,7 Cs 133	0,9 Ba 137	57 La 139	1,6 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	1,8 Tℓ 204	1,8 Pb 207	1,9 Bi 209	2,0 Po	2,5 At	86 Rn
0,7 Fr 87	0,9 Ra 226	89 Ac															

							58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
							90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

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